AMENDMENTS TO THE CLAIMS:

This listing of claims will replace all prior versions, and listings, of claims in the application:

LISTING OF CLAIMS:

1. (Currently Amended) A method for creating a simulation of flow of N materials and their interfaces in a computational domain, the method comprising the steps of:
   (a) creating a macrogrid including control volumes on a computational domain in which N materials and their interfaces are to be tracked, wherein the number N of materials tracked is at least 2;
   (b) overlaying a microgrid including microgrid cells upon the macrogrid with each of the microgrid cells being coupled to a control volume;
   (c) initializing the macrogrid and control volumes with initial and boundary conditions;
   (d) assigning a unique identifier to each of the N materials and to the microgrid cells;
   (e) calculating volume fractions for the N-materials in the control volumes;
   (f) solving equations of motion upon the macrogrid and control volumes utilizing the calculated volume fractions to arrive at local velocity conditions for the control volumes;
   (g) advecting the microgrid cells within the microgrid based on the calculated local velocity conditions in the control volumes such that voids and overlaps of the microgrid cells in the microgrid occur~~, wherein whether voids and overlaps are present is calculated using a product of the unique identifiers~~;
   (h) calculating whether voids and overlaps are present using a product of the unique identifiers;
   ~~(h)~~ (i) reallocating the microgrid cells so that only one material is in each microgrid cell to effectively conserve mass and satisfy local fluid fraction gradient values; ~~and~~
   ~~(i)~~ (j) repeating steps ~~(e)-(h)~~ (e)-(i) until the simulation is complete; and
   (k) outputting the simulation.

2. (Previously Presented) The method of claim 1 wherein:
   the unique identifiers are prime numbers.

3. (Previously Presented) The method of claim 1 wherein:
   the unique identifiers are numbers generated by an Eulerian quadratic number generator.

4. (Previously Presented) The method of claim 2 wherein:
modular arithmetic is used to track the materials which are advected into the microgrid cells.

5. (Original) The method of claim 1 wherein:
the number N of materials tracked is at least 3.

6. (Original) The method of claim 1 wherein:
the number N of materials tracked is at least 4.

7. (Previously Presented) The method of claim 1 wherein:
the interfaces between the N materials are tracked by location of the microgrid cells containing different materials.

8. (Currently Amended) A method for determining whether overlapping cells and voids are present in a grid of a fluid dynamics computation comprising:
assigning unique identifiers to cells located in a grid, the unique identifiers being associated with respective fluid materials;
advecting the cells within a grid based on local velocity conditions such that some of the cells overlap one another in the grid and voids are created in the grid; ~~and~~
calculating whether overlapping cells and voids are present in the grid using a product of the unique identifiers of each of the cells located at a particular microgrid location; and
outputting a chart corresponding to the fluid materials in the cells with the product of the unique identifiers at overlapping cells present in the grid.

9. (Previously Presented) The method of claim 8 wherein:
the unique identifiers are prime numbers.

10. (Previously Presented) The method of claim 8 wherein:
modular arithmetic is applied to the product of the unique identifiers of overlapping cells to determine which fluid materials are present in overlapping cells.

11. (New) The method of claim 8 wherein:
the chart corresponding to the fluid materials in the cells has a numeral "1" at voids present in the grid.